इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 15100 (2001): Multifunction Valve Assembly for Permanently Fixed Liquefied Petroleum Gas (LPG) Containers for Automotive Use [MED 16: Gas Cylinders]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

मोटर वाहनों में प्रयुक्त स्थायी रूप से बने द्रवित पैट्रोलियम गैस आधानों के लिए बहुप्रकायत्मिक वाल्व असेम्बली

Indian Standard

MULTI FUNCTION VALVE ASSEMBLY FOR PERMANENTLY FIXED LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS FOR AUTOMOTIVE USE

ICS 23.060; 43.040, 75.160.30

© BIS 2001

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2001 **Price Group 8**

Gas Cylinder Sectional Committee, ME 16

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard is for Multi Function Valve Assembly for permanently fixed liquefied petroleum gas (LPG) containers for automotive vehicle service only and it is desirable that the level of safety currently existing for other pressure fittings must also be maintained.

Owners and users of LPG containers should note that Multi Function Valve Assembly designed to this standard is to operate safely if used in accordance with specified service conditions for a specified finite service life only. It is the responsibility of the owners and users to ensure that Multi Function Valve Assembly is periodically tested as per norms laid down in *Gas Cylinder Rules*, 1981, as amended from time to time and as enforced by statutory authorities under these rules.

In preparing this standard, assistance has been derived from the following documents:

a) UN Regulation No. 67, Uniform Provision Concerning: Part I – Approval of specific equipment of motor vehicles using liquefied petroleum gases in their propulsion system,
b) UN Economic and Social Council Document No. TRANS/WP 29/656,
c) AS/NZS 1425 : 1999 Specification for LP fuel systems for vehicle engines,
d) Draft Indian Auto LPG Standard formulated by the expert group constituted by Ministry of Petroleum and Natural Gas,
e) IEC 68-2-52 : 1996 Salt mist cyclic test, and
f) ISO 1817 : 1999 Vulcanized Rubber—Determination of Effect of Liquids and ISO 6957 : 1988 Copper Alloys—Ammonia Test for Stress Corrosion Resistance.

The composition of the committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test of analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

MULTI FUNCTION VALVE ASSEMBLY FOR PERMANENTLY FIXED LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS FOR AUTOMOTIVE USE

1 SCOPE

1.1 This standard specifies materials, design, construction and testing requirements for multi function valve assembly for permanently fixed type of Liquefied Petroleum Gas (LPG) containers for automotive use. This standard covers multi function valves of both liquid and vapour withdrawal type.

2 REFERENCES

2.1 The standards listed in Annex A are necessary adjuncts to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY AND CONFIGURATION

3.1 Multi function valve assembly shall constitute the following components (*see* Fig. 1).

3.1.1 *Automatic Fill Limiter*

A device that automatically terminates filling when the liquid level in the container has reached maximum 80 percent of the capacity of the container.

3.1.2 *Service Valve*

3.1.2.1 A remotely controlled and normally closed, shut off valve, which can open or close the LPG supply to the vaporizer/pressure regulator for maintenance, servicing or emergency requirements.

3.1.2.2 The service valve shall be fitted down stream of an excess flow check valve.

3.1.2.3 The remotely controlled service valve with excess flow check valve shall be controlled such that it is automatically closed when the engine is not running, irrespective of the position of the ignition switch, and shall remain closed as long as the engine is not running.

3.1.3 *Excess Flow Check Valve*

3.1.3.1 A valve normally in the open position, which closes automatically in the direction of flow for which it is designed, when pressure difference over the valve exceeds 0.1 MPa. At this pressure difference the flow shall not exceed more than 10 percent above nor less than 20 percent below the rated closing flow rate capacity specified by the manufacturer.

3.1.3.2 The excess flow check valve shall be designed with an equalizing device, which should be operated manually or self-actuating to allow for pressure equalization.

3.1.3.3 When the excess flow check valve is in cut-off position, the flow through the equalizing device shall not exceed 500 cm^3/min at a differential pressure of 0.7 MPa.

3.1.4 *Pressure Relief Device*

3.1.4.1 *Pressure Relief Valve* (*PRV*)

3.1.4.1.1 Pressure relief valve means an automatic pressure-relieving device, actuated by the static pressure upstream of the valve, which opens in proportion to the increase in pressure over the opening pressure to maintain internal fluid pressure.

3.1.4.1.2 The design pressure of multi function valve shall be 2 MPa. The pressure relief valve shall be set at a pressure of 110 percent of the above design pressure and have adequate relieving capacity as specified in IS 5903 to prevent internal pressure rising above 120 percent of the set pressure of relief valve.

3.1.4.1.3 The relief valve shall communicate directly with the vapour space of the auto LPG container with no valve in between.

3.1.4.1.4 The relief valve shall reset at pressure not less than 90 percent of the set pressure of relief valve.

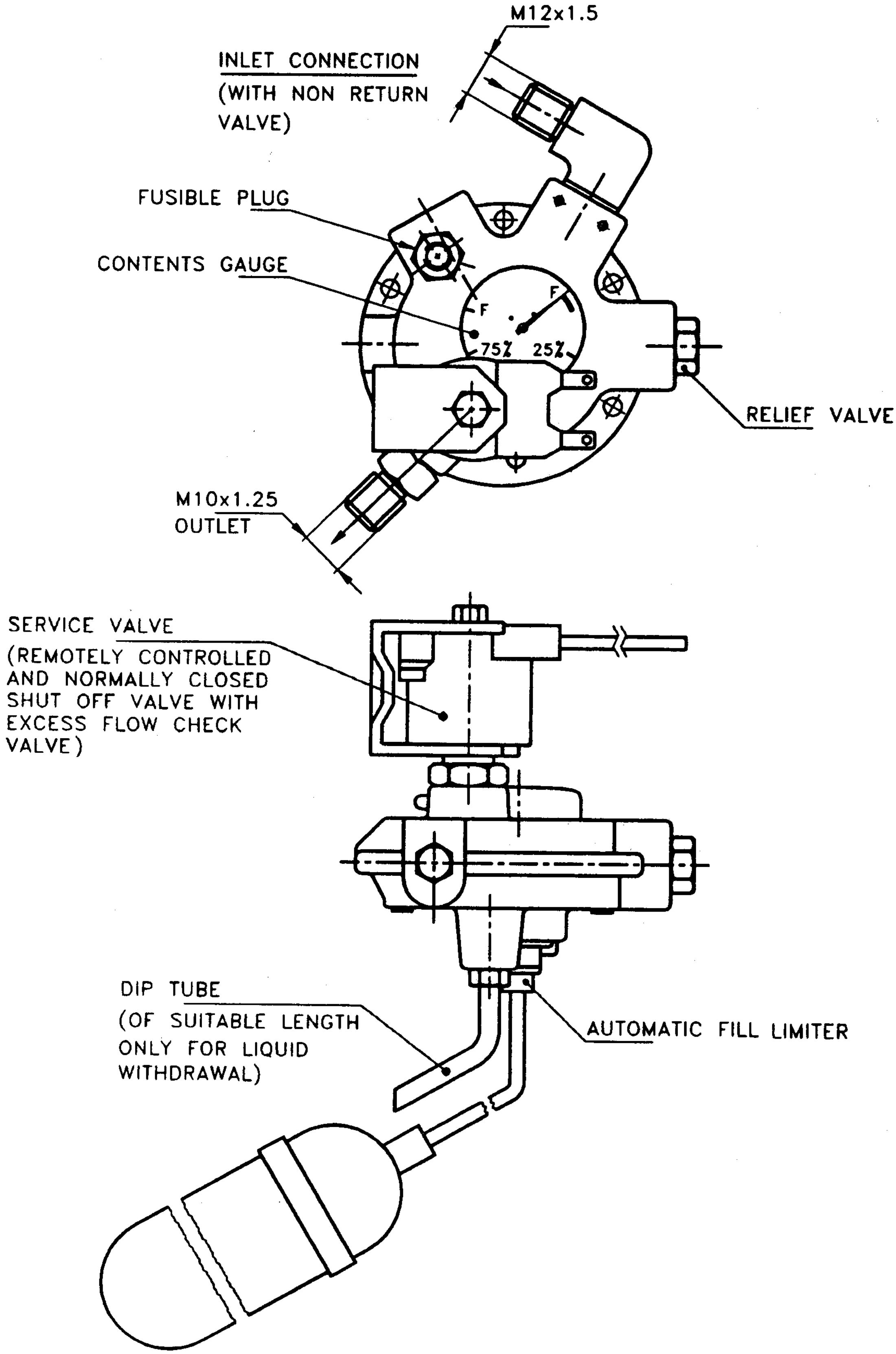
3.1.4.2 *Fusible Plug*

Fusible plug shall be provided with alloy having melting point of 100°C + 4°C / –2°C and shall comply with relevant requirements of IS 5903.

3.1.5 *Contents Gauge*

3.1.5.1 It means a gauge, which gives a visual indication of the level or quantity of the LPG contained in auto LPG container.

3.1.5.2 The content gauge shall be of an indirect type (for example magnetic) between the inside and outside of the container.



All dimensions in millimetres.

FIG. 1 GENERAL LAYOUT OF MULTI FUNCTION VALVE (ILLUSTRATIVE)

3.1.5.3 If the contents gauge comprises a float, the float shall withstand an outside pressure of 3 MPa.

NOTE — Multi function valve seal box – It shall be a metallic box which covers the multi function valve, its joints with auto LPG container and its fittings.

a) Its construction shall be such that any gas, which might leak from any of above fittings, cannot pass to any other enclosed compartment, passenger space or luggage space of the vehicle.

b) The multi function valve seal box shall provide free passage to atmosphere away from passenger compartment through a suitable flexible pipe.

c) The multi function valve seal box shall meet all the requirements of safety code of practice for auto LPG.

3.2 Filler Connector

The filler connector shall be suitable for an automatic quick disconnection of the coupling of the filler unit. When such filler unit is connected it should make leak-proof joint with the filler connector (*see* Fig. 2 and 3).

3.2.1 *Filler Cap*

The cap shall be pressure retaining type and connection shall be designed so as to relieve accumulated pressure when unscrewed by not more than one turn.

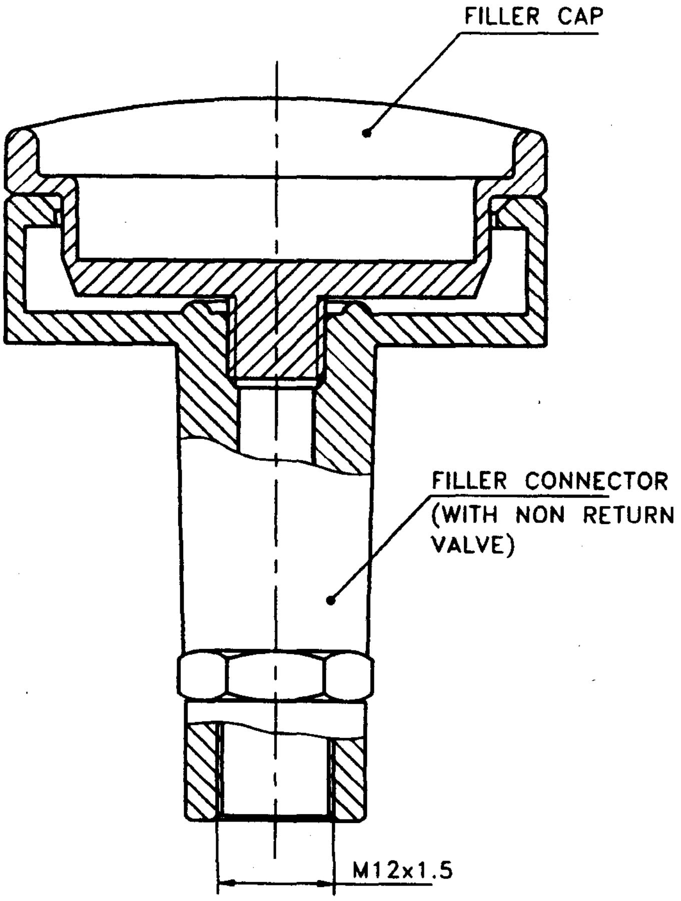
3.2.2 *Filler Non Return Valve*

Filler non-return valve shall permit LPG flow only to the container and shall prevent flow of LPG in opposite direction.

4 MATERIAL

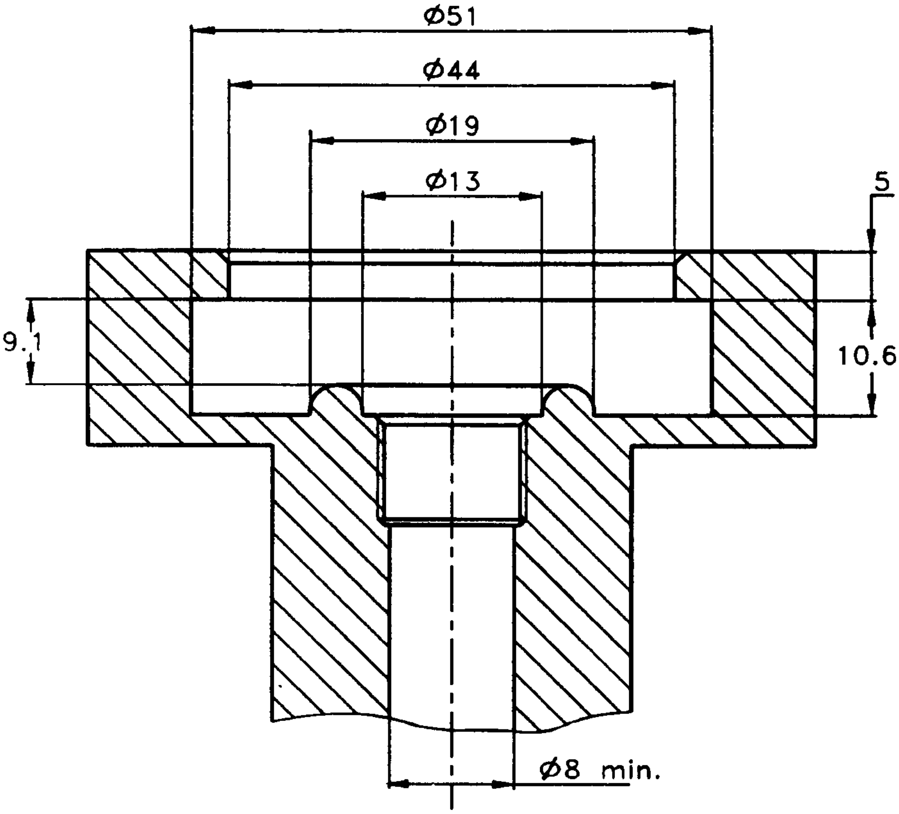
4.1 All the components used in multi-function valve shall be made of material compatible with LPG and with the material of auto LPG container.

The multi function valve body and or service valve body shall be forged from wrought or extruded sections. The material of the multi-function valve body and or service valve body shall comply with the following properties.



All dimensions in millimetres.

FIG. 2 GENERAL LAYOUT OF FILLER CONNECTOR WITH CAP (ILLUSTRATIVE)



All dimensions in millimetres.

FIG. 3 GENERAL LAYOUT OF FILLER CONNECTOR (ILLUSTRATIVE)

4.1.1 *Tensile Strength and Elongation*

The tensile strength and elongation of the material of valve body determined according to IS 1608, shall be respectively at least 392 N/mm^2 (40 kgf/mm^2) and 18 percent measure on a gauge length $5.65\sqrt{S_0}$, S_0 being the original area of cross section.

4.1.2 *Impact Strength*

The izod impact strength of the material of valve body determined according to IS 1598 shall not be less than 21.5 N.m (2.2 kg.m).

4.2 Test Samples

Test samples for tensile and izod impact tests shall, where practicable, be taken from a valve body blank, where this is not practicable, the test sample shall be made from the same raw material (wrought or extruded section) giving the same outside shape as the valve body blanks it represents. The scale of sampling and criteria for conformity shall be in accordance with the requirements as per **4.2.1**, unless otherwise agreed between the manufacturer and the purchaser.

4.2.1 *Scale of Sampling*

4.2.1.1 *Lot*

All the valve blanks of the same material, size and produced under similar conditions of manufacture shall be grouped together to constitute a lot.

4.2.1.2 Valve blanks shall be selected from each lot separately and then tested, for ascertaining their conformity to the requirements of mechanical properties.

The number of valve blanks to be selected from a lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 1. All the samples shall be taken randomly from the lot and for this purpose reference may be made to IS 4905.

4.2.2 *Number of Tests and Criteria for Conformity*

4.2.2.1 All the valve blanks selected according to col 2 of Table 1 shall be divided into two equal sets. Each of the samples in the first set shall be tested for tensile and elongation and the second set for izod impact strength.

4.2.2.2 The lot shall be declared as conforming to the requirements of mechanical properties if it has been found satisfactory according to **4.1.1** and **4.1.2**. If any of the tests samples fails to meet the requirements of **4.1.1** and **4.1.2** additional specimens equal to twice the number of samples size for the failed tests in the same lot shall be taken and tested for failed tests only. If any of these specimens fails to meet the requirements, the entire lot represented shall be rejected.

Table 1 Scale of Sampling
(*Clauses* 4.2.1.2 *and* 4.2.2.1)

Lot Size (1)	Sample Size (2)
Up to 500	10
501 to 3 200	14
3 200 to 10 000	20
10 001 to 35 000	32
35 001 and above	50

4.3 All rubber and other moulded parts coming in contact with LPG in the construction of the multi function valve shall be compatible with LPG, when tested according to **9.9**. All rubber and other moulded parts shall be suitable for extreme climatic conditions in which the multi function valve is likely to be used, the range of temperature being –20°C to 65°C. The method of test shall be according to **9.4** and **9.5**.

4.4 The brass parts of multi function valve shall not be susceptible to season cracking. The susceptibility to season cracking shall be determined by the method given in IS 2305.

5 CONSTRUCTION AND WORKMANSHIP

5.1 The multi function valve, including all the components, shall be mechanically strong, of sound construction and of a high standard of workmanship and finish.

5.2 The components of a multi function valve shall be interchangeable with the corresponding components of any other multi function valve of the same model and size by the same manufacturer.

5.3 The minimum finished wall thickness at any portion of the multi function valve shall not be less than 2.5 mm. However this requirement shall be relaxed in case of sections not susceptible to tamper, damage or rupture during use, or where any damage or rupture to the section will not affect the sealing off of the multi function valve.

5.4 Screw Threads

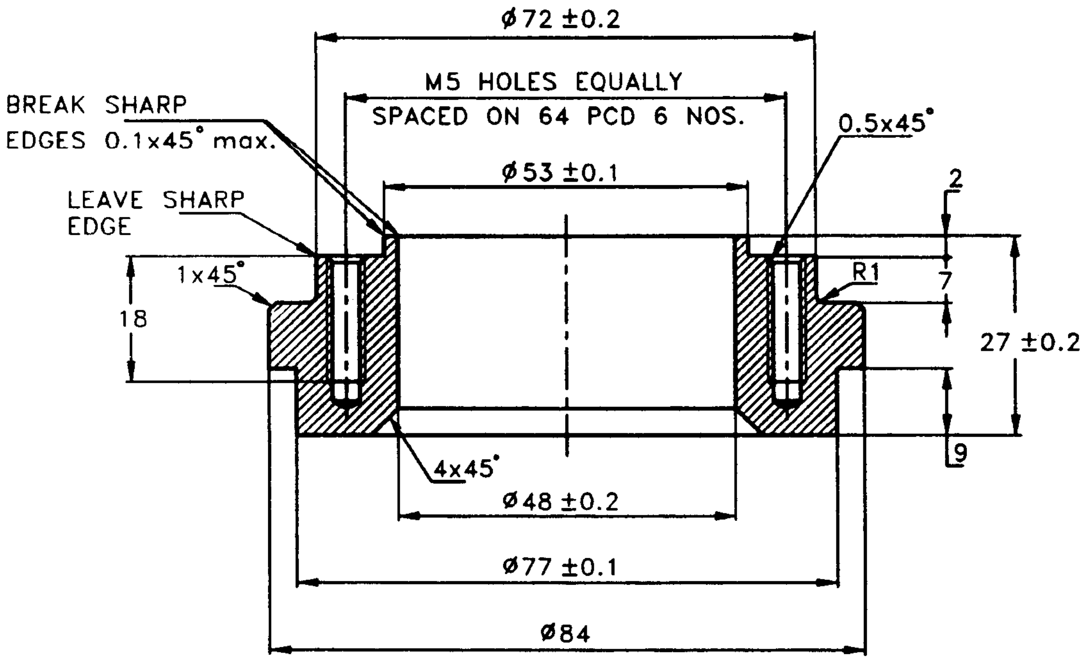
Except for the end connections of the multi function valve, the screw threads shall comply with the requirements of IS 554 or IS 2643 or IS 4218 (Parts 1 to 4).

NOTE — As these fittings will be subjected to vibrations on roads, rattle and bumps, adhesive compatible with LPG may be used while fitting the screws, studs and nuts, etc.

5.5 Connections

5.5.1 *Mounting of Multi Function Valve*

Multi function valve sub-assemblies are fitted on matching flange of the LPG auto container as shown in Fig. 4 and fixed with high tensile cap screws. sealing gasket / 'O' rings of suitable material shall be used to make the joint between the flange of the LPG auto container and the block/housing of the multi functional valve leak proof. Sizes given in Fig. 4 are only for



MATERIAL — FORGED STEEL

All dimensions in millimetres.

FIG. 4 FLANGE OF LPG AUTO CONTAINER

guidance. However different dimensions acceptable to the manufacturer and purchaser may be used.

5.5.2 *Inlet Connection*

The multi function valve inlet shall have parallel male threads of minimum size of M12 × 1.5.

5.5.3 *Outlet Connection*

The multi function valve outlet shall have parallel male threads of minimum size of M10 × 1.25.

NOTE — The multi function valve outlet and inlet may be at any angle easily accessible for connections.

6 TYPE OF MULTI FUNCTION VALVES AND THEIR MINIMUM CONSTRUCTION REQUIREMENTS

6.1 Filler connector shall be fitted with non-return valve and service valve shall be fitted with excess flow check valve on the upstream/inlet side of the service valve.

6.2 The general machining tolerances unless otherwise stated shall be of medium class specified in IS 2102 (Part 1).

7 TESTS

7.1 For the automatic fill limiter, service valve, excess flow check valve, pressure relief valve following tests shall be conducted as per procedure given at **9** :

a) Over pressure test	(*see* **9.2**)
b) External leakage test	(*see* **9.3**)
c) High temperature test	(*see* **9.4**)
d) Low temperature test	(*see* **9.5**)
e) Seat leakage test	(*see* **9.6**)
f) Endurance test	(*see* **9.7**)
g) Operational test	(*see* **9.8**)
h) LPG compatibility test	(*see* **9.9**)
j) Corrosion resistance test	(*see* **9.10**)
k) Resistance to dry heat test	(*see* **9.11**)
m) Ozone ageing test	(*see* **9.12**)
n) Creep test	(*see* **9.13**)
p) Temperature cycle test	(*see* **9.14**)

7.2 For contents gauge following tests shall be carried out:

a) Over pressure test	(*see* **9.2**)
b) External leakage test	(*see* **9.3**)
c) High temperature test	(*see* **9.4**)
d) Low temperature test	(*see* **9.5**)
e) LPG compatibility test	(*see* **9.9**)
f) Corrosion resistance test	(*see* **9.10**)
g) Resistance to dry heat test	(*see* **9.11**)
h) Ozone ageing test	(*see* **9.12**)
j) Creep test	(*see* **9.13**)
k) Temperature cycles test	(*see* **9.14**)

8 TYPE APPROVAL TEST

8.1 Design and Fabrication

Before the design of the valve is approved, it shall be checked for conformity to all requirements of this standard. Whenever there is a change in material or basic design of the multi function valve, it shall be re-tested and shall conform to all the requirements of this standard. For the purpose of this clause, change in material implies a basic change from one type of material to another, such as steel to copper, etc.

8.2 Cycle Test

The following components used in multi function valve shall perform satisfactorily for not less than 6 000 cycles of opening and closing operations of normal working operations:

a) Service valve,
b) Excess-flow valve, and
c) Pressure relief valve.

During the cycle test, the valves shall be closed in every cycle positively. After the cycle test, the valves shall be checked for the conformity to the respective requirements of this specification and shall perform satisfactorily.

9 TEST PROCEDURE

9.1 General Requirements

9.1.1 Leakage test shall be conducted with pressurized gas like air or nitrogen.

9.1.2 Water or another fluid may be used to obtain the required pressure for the hydrostatic strength test.

9.1.3 All test values shall indicate the type of test medium used, if applicable.

9.1.4 The test period for the leakage and hydrostatic strength tests shall not be less than one minute.

9.1.5 All tests shall be performed at a room temperature of 20°C ± 5°C, unless otherwise stated.

9.1.6 The design pressure of the multi function valve shall be 2 MPa.

9.2 Over Pressure Test

A LPG containing component shall withstand without any visible evidence of rupture or permanent distortion a hydraulic test pressure of 4.5 MPa (2.25 times the maximum design pressure). During the minimal one minute with the outlet of the high-pressure part plugged.

The samples shall be connected to a source of hydrostatic pressure positive shut off valve and a pressure gauge, having pressure range of not less than 1.5 times nor more than 2 times the test pressure, shall be installed in the hydrostatic pressure supplying piping.

9.3 External Leakage Test

9.3.1 A component shall be free form leakage through stem or body seals or other joints, and shall not show evidence of the porosity when tested as specified in **9.3.3** at any aerostatics pressure up to 2 MPa.

9.3.2 The test shall be performed at the following conditions:

a) at room temperature,
b) at the minimum operating temperature, and
c) at the maximum operating temperature.

The maximum and minimum operating temperatures shall be 65°C and – 20°C respectively.

9.3.3 During this test the equipment under test (*EUT*) shall be connected to a source of aerostatics pressure of 2 MPa. A positive shut-off valve and a pressure gauge having a pressure range of not less than 1.5 times nor more than 2 times the test pressure shall be installed in the pressure supply piping. The pressure gauge shall be installed between the positive shut-off valve and the sample under test. While under the applied test pressure, the sample shall be submerged in water to detect leakage or by any other equivalent test method (flow measurement or pressure drop).

9.3.4 The external leakage shall be lower than 15 cm^3/h with the outlet plugged, when submitted to a gas pressure equal to the leakage test pressure.

9.4 High Temperature Test

A LPG containing component shall not leak more than 15 cm^3/h with the outlet plugged when subjected to gas pressure equal to the leakage test pressure of 2 MPa at maximum operating temperature of 65°C. The component shall be conditioned for at least 8 h at this temperature.

9.5 Low Temperature Test

A LPG containing component shall not leak more than 15 cm^3/h with outlet plugged when subjected to a gas pressure equal to the leakage test pressure of 2 MPa at minimum operating temperature –20°C. The component shall be conditioned for at least 8 h at this temperature.

9.6 Seat Leakage Test

9.6.1 The following tests for seat leakage shall be conducted on samples of service valve or filling unit which previously been subjected to the external leakage test specified in **9.3**.

9.6.1.1 Seat leakage tests are conducted with the inlet of the sample valve connected to a source of aerostatics pressure of 2 MPa, the valve in the closed position, and with the outlet open. A positive shut-off valve and a pressure gauge having a pressure range of not less than 1.5 times nor more than 2 times the test pressure shall be installed in the pressure supply piping. The pressure gauge shall be installed between the positive shut-off valve and the sample under test. While under the applied test pressure, observations for leakage shall be made with the open outlet submerged in water unless otherwise indicated.

9.6.1.2 Conformity to the requirement specified in **9.6.2** to **9.6.8** shall be determined by connecting a length of tubing to the valve outlet. The open end of this outlet tube shall be located within an inverted graduated cylinder, which is calibrated, in cubic centimeters. The inverted cylinder shall be closed by a water seal. The apparatus shall be adjusted such that-

a) the end of the outlet tube is located approximately 13 mm above the water level within the inverted graduated cylinder, and
b) the water within and exterior to the graduated cylinder is at the same level. With these adjustments made, the water level within the graduated cylinder shall be recorded. With the valve in the closed position assumed as the result of normal operation, air or nitrogen at the specified test pressure shall be applied to the valve inlet for a test period of not less than 2 min. During this time, the vertical position of the graduated cylinder shall be adjusted, if necessary, to maintain the same water level within and exterior to it.

At the end of the test period and with the water within and exterior to the graduated cylinder at the same level, the level of water within the graduated cylinder is again recorded. From the change of volume within the graduated cylinder, the leakage rate shall be calculated according to the following formula:

$$V_1 = V_t \cdot \frac{60}{t} \cdot \left(\frac{273}{T} \times \frac{P}{0.1016} \right)$$

where

V_1 = leakage rate, cubic centimeters of air or nitrogen per hour,
V_t = increase in volume within graduated cylinder during test,

t = time of test, minutes,

P = barometric pressure during test, in MPa, and

T = ambient temperature during, in °K.

9.6.1.3 Instead of the method described above, leakage may be measured by a flowmeter installed on the inlet side of the valve under test. The flowmeter shall be capable of indicating accurately, for the test fluid employed, the maximum leakage flow rates permitted.

9.6.2 The seat of a shut-off valve, when in the closed position, shall be free from leakage aerostatics pressure up to 2 MPa.

9.6.3 A non-return valve provided with resilient seat, when in the closed position, shall not leak when subjected to any aerostatics pressure between 0.05 MPa and 2 MPa.

9.6.4 A non-return valve provided with a metal-to-metal seat, when in the closed position, shall not leak at a rate exceeding 0.50 dm^3/h of air when subjected to an inlet pressure up to the test pressure of 2 MPa.

9.6.5 The seat of the upper non-return valve used in the assembly of a filling unit, when in the closed position, shall be free from leakage at any aerostatics pressure between 0.05 MPa and 2 MPa.

9.6.6 The seat of a service coupling, when in the closed position, shall be free from leakage at any aerostatics pressure up to 2 MPa.

9.6.7 The pressure relief valve (discharge valve) shall not have internal leakage up to1.8 MPa.

9.7 Endurance Test

A filling unit and service valve shall be capable of conforming to the applicable leakage in test requirements laid down in **9.3** and **9.6**, after being subjected to 6 000 number of cycles of opening and closing.

A shut-off valve shall be tested with the valve outlet plugged. The valve body filled with *n*-hexane, and the valve inlet subjected to a pressure of 2 MPa.

An endurance test shall be conducted at a rate not faster than 10 times per minute.

The appropriate tests for external and seat leakage, as described under external leakage test specified in **9.3** and seat leakage test specified in **9.6** shall be conducted immediately following the endurance test.

9.8 Operational Tests

9.8.1 *Operation Test of the Pressure Relief Valve*

9.8.1.1 In the case of pressure relief valves, three samples of each size, design, and setting shall be used for start-to-discharge and resealing pressure tests. This same set of three valves shall be used for flow capacity tests for other observations indicated below.

Not less than two successive start-to-discharge and resealing pressure observations shall be made on each of the three test valves under Test No. 1 to 3 given at **9.8.1.2** to **9.8.1.4**.

9.8.1.2 *Start-to-discharge and resealing pressures of pressure relief valves* (Test No. 1)

9.8.1.2.1 Before being subjected to a flow capacity test, the start-to-discharge pressure of each of three samples of a pressure relief valve of a specific size, design, and setting shall be within + 3 percent of the average of the pressures, but the start-to-discharge pressure of any one of the three valves shall be not less than 95 percent, not more than 105 percent, of the set pressure marked on the valve.

9.8.1.2.2 The resealing pressure of a pressure relief valve before being subjected to a flow capacity test shall be not less than 90 percent of the initially observed start-to-discharge pressure.

9.8.1.2.3 A pressure relief shall be connected to an air or other aerostatics supply source capable of being maintained at pressure of at least 0.5 MPa effective pressure above the marked set pressure of the valve being tested. A positive shut-off valve and a pressure gauge having a pressure range of not less than 1.5 times nor more than 2 times the test pressure shall be installed in the pressure supply piping. The pressure gauge shall be installed in the piping between the valve being tested and the positive shut-off valve. Start-to-discharge and resealing pressure shall be observed through a water seal not over 100 mm in depth.

9.8.1.2.4 After recording the start-to-discharge pressure of the valve, the pressure shall be increased sufficiently above the start-to-discharge pressure to ensure unseating of the valve. The shut-off valve is then to be closed tightly and the water seal, as well as the pressure gauge, shall be observed closely. The pressure at which bubbles through the water seal cease shall be recorded as the resealing pressure of the valve.

9.8.1.3 *Flow capacity of pressure relief valves* (Test No. 2)

9.8.1.3.1 The flow capacity of each of three samples of pressure relief valve of specific size, design, and setting shall fall within a range of 10 percent of the highest observed capacity.

9.8.1.3.2 During flow capacity tests on each valve, there shall be no evidence of chattering or other abnormal operating condition.

9.8.1.3.3 The blow-down pressure of each valve shall be not less than 65 percent of the initially recorded start-to-discharge pressure.

9.8.1.3.4 A flow capacity test on a pressure relief valve shall be conducted at a flow rating pressure of 120 percent of the maximum set pressure.

9.8.1.3.5 A flow capacity test on a pressure relief valve shall be conducted by utilizing a properly designed and calibrated orifice flowmeter or other type of flow measuring device connected to a source of air supply of adequate capacity and pressure. Modifications of the flow meter from that described herein, and an aerostatics flow medium other than air, may be used provided the end results are the same.

9.8.1.3.6 The flow meter shall be arranged with sufficiently long length of pipe both preceding and following the orifice, or the other arrangements including straightening vanes, to assure no disturbance at the orifice place for the ratios of orifice to pipe diameters to be employed.

Flanges between which the orifice plate is located and clamped shall be provided with pressure take-off lines connected to a manometer. This instrument indicates the pressure differential calculation. A calibrated pressure gauge shall be installed in that portion of the meter pipe downstream of the orifice plate. This gauge indicates the flow pressure and the reading are also used in the flow calculation.

9.8.1.3.7 A temperature-indicating instrument shall be connected to the meter pipe downstream of the orifice plate to indicate the temperature of the air flowing to the safety valve. The reading of this instrument shall be integrated in the calculation to correct the temperature of the airflow to a 15°C base temperature. A barometer shall be available for indicating the prevailing atmospheric pressure.

The reading of the barometer shall be added to the indicated airflow gauge pressure. This absolute pressure is similarly to be integrated in the flow calculation. The air pressure to the flow meter shall be controlled by a suitable valve installed in the air-supply piping ahead of the flow meter. The pressure valve under test shall be connected to the discharge end of the flow meter.

9.8.1.3.8 After all preparations for flow capacity tests have been made, the valve in the air-supply line shall be opened slowly and the pressure to the valve under test shall be increased to the appropriate flow rating pressure. During this interval, the pressure at which the valve "pops" opens shall be recorded as the popping pressure.

9.8.1.3.9 The predetermined flow rating pressure shall be maintained constant for a brief interval until the readings of the instruments become stabilized. Readings of the flow pressure gauge, pressure differential manometer, and the flowing air temperature indicator shall be recorded simultaneously. The pressure is then to be decreased until there is no further discharge from the valve.

The pressure at which this occurs shall be recorded as the blow down pressure of the valve.

9.8.1.3.10 From the recorded data and the known orifice coefficient of the flowmeter, the air-flow capacity of the pressure relief valve tested shall be calculated using the following formula :

$$Q = \frac{F_b . F_t \sqrt{0.1} \times h \times p}{60}$$

where

Q = flow capacity of pressure relief valve, in m^3/min. of air at 100 kPa absolute and at 15°C.

F_b = basic orifice factor of flow meter at 100 kPa absolute and at 15°C.

F_t = flowing air temperature factor to convert recorded temperature to base of 15°C.

h = differential pressure across orifice of meter in kPa.

p = flowing air pressure to pressure relief valve, in kPa absolute (recorded gauge pressures plus recorded barometric pressure).

60 = denominator to convert equation from m^3/h to m^3/min.

9.8.1.3.11 The average flow capacity of the three pressure relief valves rounded off to the nearest five units shall be taken as the flow capacity of the valve of that specific size, design and setting.

9.8.1.4 *Recheck start-to-discharge and resealing pressures of pressure relief-valves* (Test No. 3)

Subsequent to flow capacity tests, the start-to-discharge pressure of a pressure relief valve shall be not less than 85 percent and the resealing pressure shall be not less than 80 percent of the initial start to discharge and resealing pressures recorded under Test No. 1 (*see* **9.8.1.2**).

These tests shall be conducted approximately 1 h after the capacity test, and the test procedure shall be the same as described under Test No. 1 (*see* **9.8.1.2**).

9.8.2 *Operation Test.Excess Flow Valve*

9.8.2.1 An excess flow valve shall operate at not more than 10 percent above, nor less than 20 percent below the rated closing flow capacity specified by the manufacturer, and shall close automatically at a pressure differential across the valve of not more than 0.1 MPa during the operation tests described below.

9.8.2.2 Three samples of each size and style of valve shall be subjected to these tests. A valve intended for use only with liquid shall be tested with water, otherwise the tests shall be made both with air and with water. Except as specified in **9.8.2.3**, separate tests shall be run with each sample installed in vertical, horizontal and inverted positions. The tests with air shall be made without piping or other restriction connected to the outlet of the test sample.

9.8.2.3 A valve intended for installation in one position only shall be tested only in that position.

9.8.2.4 The test with air shall be conducted by utilizing a properly designed and calibrated orifice flowmeter of the flange type connected to a source of air supply of adequate capacity and pressure.

9.8.2.5 The test sample shall be connected to the outlet of the flowmeter. A manometer or calibrated pressure-gauge reading in increments of not more than 0.003 MPa shall be installed on the upstream side of the test sample to indicate the closing pressure.

9.8.2.6 The test shall be conducted by slowly increasing the flow of air through the flowmeter until the check valve closes. At the instant of closing, the pressure differential across the flowmeter orifice and the closing pressure indicated by the gauge shall be recorded. The rate of flow at closing is then to be calculated.

9.8.2.7 Other types of flowmeters and a gas, other than air, may be used.

9.8.2.8 The test with water shall be conducted using a liquid flowmeter (or equivalent) installed in a piping system having sufficient pressure to provide the required flow. The system is to include an inlet piezometer or pipe at least one pipe size larger than the valve to be tested, with a flow control valve connected between the flowmeter and piezometer. A hose or hydrostatic relief valve, or both may be used to reduce the effect of the pressure shock when the excess flow valve closes.

9.8.2.9 The test sample shall be connected to the outlet end of the piezometer. A manometer or calibrated pressure gauge of the retard type, which will permit readings up to 1.440 MPa, shall be connected to a pressure take-off on the upstream side of the test sample to indicate the closing pressure. The connection shall be made using a length of rubber hose between the pressure gauge and the pressure take-off, with a valve installed at the gauge inlet to permit bleeding air from the system.

9.8.2.10 Prior to the test, the flow control valve shall be opened slightly, with the bleed valve at the pressure gauge open, to eliminate air from the system. The bleed valve is then to be closed and the test is conducted by slowly increasing the flow until the check valve closes. During the test the pressure gauge shall be positioned at the same level as the test sample. At the instant of closing, the rate of flow and closing pressure are to record. When the excess flow valve is at cut-off position, the leakage rate of flow is to record.

9.8.3 *Operational Test for Remotely Controlled Service Valve*

9.8.3.1 *Electrical over voltage test*

The electrical components or devices containing electrical sub components of the remotely controlled service valve shall withstand application of 1.5 times the rated voltage ± 5 percent for the periods of 3 minutes without failure.

9.8.3.2 *Insulation resistance test*

This test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the case of the remotely controlled service valve. A voltage of 1 000 V D.C. shall be applied between one of the connector pins and the housing of the remotely controlled service valve for at least two seconds. The minimum allowable resistance shall be 240 kilo ohm.

9.8.3.3 *Minimum opening voltage test*

The minimum opening voltage at room temperature shall be less than or equal to eight voltage for a 12 V system and less than or equal to sixteen voltage for a 24 V system.

9.8.4 *Charging-Speed Test*

Testing of the good function of the device limiting the filling degree of the container has to be performed by filling speeds of 20, 50 and 80 litres per minute.

9.8.5 *Endurance Test for the Fill Limiter*

The device limiting the filling degree of the container shall be capable of withstanding 6 000 complete filling cycles to the maximum filling degree.

NOTE — This test is applicable for automatic fill limiter.

9.8.6 *Vibration Test Procedure*

9.8.6.1 *General*

Any device limiting the filling degree of the container and operating by a float, after having been subjected to the tests verifying that:

a) It limits the degree of filling of the container to 80 percent or less of its capacity; and
b) It does not allow, 'at the cut-off position', any filling of the container at a rate exceeding one litre per minute.

The device shall be subjected to one of the test procedure specified in **9.8.6.5** or **9.8.6.6** to ensure that the device is constructed to withstand expected dynamic vibrational stresses and to ensure that performance degradations or malfunctions will not be produced by the service vibration environment.

9.8.6.2 *Equipment and mounting technique*

The test item shall be attached to the vibration equipment by its normal mounting means, either directly to the vibration exciter or transition table, or by means of a rigid fixture capable of transmitting the specified vibration conditions. Equipment used to measure and/or record the acceleration level or amplitude level and the frequency shall have an accuracy of at least 10 percent of the measured value.

9.8.6.3 *Choice of procedure*

At the choice of the authority granting type-approval, the tests shall be performed according to either procedure A (*see* **9.8.6.5**) or procedure B (*see* **9.8.6.6**).

9.8.6.4 *General*

The following tests shall be carried out along each of the three orthogonal axes of the test item.

9.8.6.5 *Procedure A*

9.8.6.5.1 *Resonance search*

Resonant frequencies of the fill limiter shall be determined by varying the frequency of applied vibration slowly through the specified range at reduced test levels but with sufficient amplitude to excite the item. Sinusoidal resonance search may be performed using the test level and cycling time specified for the cycling test, provided the resonance search time is included in the required cycling test time (*see* **9.8.6.5.2**).

9.8.6.5.2 *Resonance dwell test*

The test item shall be vibrated for 30 min along each axis at the most severe resonant frequencies determined in **9.8.6.5.1**. The test level shall be 1.5 g (g = 9.81 m/s^2). If more than four significant resonant frequencies are found for any one axis, the four most severe resonant frequencies shall be chosen for this test. If a change in resonant frequency occurs during the test, its time of occurrence shall be recorded and immediately the frequency shall be adjusted to maintain the peak resonance condition. The final resonant frequency shall be recorded. The total dwell test time shall be included in the required cycling test time (*see* **9.8.6.5.3**).

9.8.6.5.3 *Sinusoidal cycling test*

The test item shall be sinusoidally vibrated for three hours along each of its orthogonal axes in accordance with:

a) an acceleration level of 1.5 g (g = 9.81 m/sec^2);
b) a frequency range of 5 to 200 Hz; and
c) a sweep time of 12 min.

The frequency of applied vibration shall be swept over the specified range logarithmically.

The specified sweep time is that of an ascending plus a descending sweep.

9.8.6.6 *Procedure B*

9.8.6.6.1 The test shall be performed on a sinusoidal vibration bench at a constant acceleration of 1.5 g (g = 9.81 m/s^2) and at frequencies ranging between 5 to 200 Hz. The test shall last for 5 h for each of the axes specified in **9.8.6.4**. The frequency band 5 to 200 Hz shall be covered in each of the two senses in 15 min.

9.8.6.6.2 Alternatively, in case the test is not conducted by utilizing a constant acceleration bench, the frequency band from 5 to 200 Hz shall be subdivided in 11 semi-octave bands, each of them covered by a constant amplitude, so that the theoretical acceleration is included between 1 to 2 g (g = 9.81 m/s^2).

Vibration amplitude for each band is as follows:

Amplitude (crest value) mm	*Frequency (for acceleration* = 1 g) Hz	*Frequency (for acceleration* = 1 g) H
10	5	7
5	7	10
2.50	10	14
1.25	14	20
0.60	20	29
0.30	29	41
0.15	41	57
0.08	57	79
0.04	79	111
0.02	111	157
0.01	157	222

Each band shall be covered in both directions in

2 min, 30 min totally for each band.

9.8.6.7 *Requirements*

After having been subjected to one of the vibration test procedure described above the device shall show no mechanical failures and is deemed to conform to the vibration test requirements only in the case the values of its characteristic parameters are as under:

a) Filling degree at the cut-off position, and
b) Filling rate allowed at the cut-off position.

These values shall not exceed the prescribed limits and are not exceeding by more than 10 percent the values preceding the vibration test procedure.

9.9 LPG Compatibility Tests for Synthetic Materials

9.9.1 A synthetic part in contact with liquid LPG shall not show excessive volume change or loss of weight.

Resistance to n-pentane shall be carried out according to Annex B with the following conditions:

a) Medium : n-pentane
b) Temperature : 20°C ± 5°C (*see* **9.1.5**)
c) Immersion period : 72 h

9.9.2 *Requirements*

a) Maximum change in volume 20 percent.
b) After storage in air with a temperature of 40°C for a period of 48 h the mass compared to the original value shall not decreases more than five percent.

9.10 Corrosion Resistance

9.10.1 A metallic LPG containing component shall comply with the leakage tests (*see* **9.2, 9.3, 9.4** and **9.6)** and after having been submitted to 144 h salt spray test according to IS 10250, with all connections closed.

9.10.2 Alternatively, a metallic LPG containing component shall comply with the leakage tests specified in 9.2, 9.3, 9.4 and 9.6 and after having been subjected to a salt spray (corrosion resistance) test according to Annex C.

9.10.2.1 *Test procedure*

Before the test the component shall be cleaned according to the instructions of the manufacturer. All the connections shall be closed off. The component shall not be operated during the test.

Subsequently the component shall be submitted during two hours to spraying with a solution of salt, containing five percent sodium chloride (NaCl) (mass percent) with less than 0.3 percent contamination and 95 percent distilled or demineralised water, at a temperature of 20°C. After the spraying the component is stored at temperature of 40°C and 90 to 95 percent relative humidity for 168 h. This sequence shall be repeated four times.

After the test the component shall be cleaned and dried during one hour at 55°C. The component shall now be conditioned to reference conditions during 4 h, before submitting it to further testing.

9.10.3 A copper or brass LPG containing component shall comply with the leakage tests (*see* **9.3, 9.4** and **9.6**) and after having been subjected to 24 h immersion in ammonia according to Annex D with all connections closed.

9.11 Resistance to Dry-Heat Test

The test has to be done in compliance with IS 3400 (Part 4). The test piece shall be exposed to air at a temperature equal to the maximum operating temperature of 168 h.

a) Allowable change in tensile strength should not exceed +25 percent.
b) Allowable change in ultimate elongation shall not exceed the following values:
   1) maximum increase 10 percent
   2) maximum decrease 30 percent

9.12 Ozone Ageing Test

9.12.1 The test shall be carried out in accordance with IS 3400 (Part 20).

The test piece, which has to be stressed to 20 percent elongation, shall be exposed to air at 40°C with an ozone concentration of 50 parts per hundred million during 120 h.

There shall be no cracks on the test piece.

9.13 Creep Test

A non-metallic part containing liquid LPG shall comply with the leakage tests (*see* **9.3, 9.4** and **9.6**) after having been submitted to a hydraulic pressure of 2.25 times the maximum operating pressure at a temperature of 120°C during minimal of 96 h. Water or any other suitable hydraulic fluid may be used as a test medium.

9.14 Temperature Cycle Test

A non-metallic part containing liquid LPG shall comply with the leakage tests (*see* **9.3, 9.4** and **9.6**) after having been submitted to a 96 h temperature cycle from the minimum operating temperature up to the maximum operating temperature with a cycle time of 120 min, under maximum working pressure.

10 MARKING

10.1 Each multi function valve shall be permanently marked with the following information:

a) Quarter and year of manufacture.
b) Manufacturer's identification mark.
c) Number of this specification.
d) Maximum working pressure 2 MPa.
e) Inspector's mark.
f) Mountaining angle of multi function valve.
g) PRV flow rate at flow rating pressure.

NOTE — This safety information is necessary to prevent under rated PRV's being installed in larger capacity LPG containers.

h) Auto LPG tank diameter or height whichever is applicable.

10.2 BIS Certification Marking

The multi function valve may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

REFERRED INDIAN STANDARDS

IS No.	*Title*
319 : 1989	Free cutting brass, rods and sections (*fourth revision*)
554 : 1999	Pipe threads where pressure tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
1598 : 1977	Methods for Izod impact test for metals (*first revision*)
1608 : 1972	Mechanical testing of Metals — Tensile testing (*second revision*)
2102 (Part 1) : 1993	General tolerances for dimensions and form and position: Part 1 General tolerances for linear and angular dimensions (*third revision*).
2305 : 1988	Method for decorous nitrate test for copper and copper alloys (*first revision*)
2643 (Part 1) : 1999	Pipe threads for fastening purposes: Part 1 Basic profile and dimensions (*first revision*)
3400	Method of test for vulcanized rubbers
(Part 2) : 1995	Hardness (*second revision*)
(Part 4) : 1987	Accelerated ageing (*second revision*)
(Part 20) : 1994	Resistance to ozone cracking (*first revision*)
4218	ISO metric screw threads:
(Part 1) : 1978	Basic and design profiles (*first revision*)
(Part 2) : 1978	Diameter pitch combinations (*first revision*)
(Part 3) : 1999	Basic dimensions for design profiles (*first revision*)
(Part 4) : 1976	Tolerancing system (*first revision*)
(Part 5) : 1979	Tolerances (*first revision*)
4905 : 1968	Methods of random sampling
5903 : 1970	Recommendation for safety devices for gas cylinder
5116 : 1996	General requirements for domestic and commercial equipment for use with LPG (*third revision*)
6912 : 1985	Copper and copper alloy forging stock and forgings (*first revision*).
8737 : 1995	Valve fittings for use with liquified petroleum gas (LPG) cylinders of more than 5 l water capacity — Specification (*first revision*)
9121 : 1979	Inspection gauges for checking Type 1 (size 2) taper threads of gas cylinders valves, taper 1 in 16
10250 : 1982	Severities for environmental tests for automotive electrical equipment

ANNEX B

(*Clause* 9.9.1)

DETERMINATION OF THE EFFECT OF n-PENTANE ON VULCANISED RUBBER

B-1 PROCEDURE

B-1.1 General

Use 3 test pieces for each set of measurements and make any identification marks if required before immersion.

Immerse the test pieces in the appropriate container using n-pentane at room temperature maintain at 20°C ± 5 °C.

For total immersion, place the specimens at a distance of at least 5 mm from each other as well as sides of the container. Also specimen should be at least 10 mm above the bottom of container and 10 mm below the level of n-pentane.

The test container should be closed with a cover, and should be shielded from light during the test to avoid evaporation of n-pentane.

Immerse the test piece for 72 h +0/–2 h in n-pentane.

At the end of immersion period remove the sample from n-pentane and gently wipe off any liquid sticking on the surface.

B-1.2 Change in Mass

Weigh each test piece to the nearest milligram at room temperature before and after immersion.

Calculate the percentage change in mass m_{100} as follows:

$$m_{100} = \frac{m_i - m_0}{m_0} \times 100$$

where

m_0 = initial mass of the test piece.

m_i = mass of the test piece after immersion.

Report the result as the average value for the 3 test pieces.

B-1.3 Change in Volume

The water displacement method is used for change in volume.

Weigh each test piece in air to the nearest milligram (mass m_0), and then reweigh each test piece in distilled water at the room temperature (mass $m_{0,\ w}$) taking care to ensure that all air bubbles are removed.

Immerse each test piece in the n-pentane. At the end of period of immersion, weigh each test piece in air (mass m_i) to the nearest milligram, and then reweigh each test piece in distilled water (mass $m_{i,\ w}$) at room temperature.

Calculate the percentage change in volume V_{100} using the following equation:

$$V_{100} = \left[\frac{m_i - m_{i,w}}{m_0 - m_{0,w}} - 1\right] \times 100$$

where

m_0 = initial mass of the test piece in air;

m_i = mass of the test piece in air after immersion;

$m_{0,w}$ = initial mass of the test piece in water; and

$m_{i,w}$ = mass of the test piece in water after immersion.

Report the result as the average value for the 3 test pieces.

ANNEX C

(*Clause* 9.10.2)

CORROSION RESISTANCE TEST

C-1 TEST APPARATUS

C- 1.1 Salt Mist Chamber

The chamber for this test shall be constructed of such material that will not influence the corrosive effects of the salt mist.

The detailed construction of the chamber, including the method of producing the salt mist is optional, provided that:

a) the conditions in the chamber are within the limits specified;

b) a sufficiently large volume with constant, homogeneous conditions (not affected by turbulence) are available; these conditions should not be influenced by the specimen under test;

c) no direct spray impinges upon the specimen under test;

d) drop of liquid accumulating on the ceiling, the walls, or other parts cannot drip on the specimen; and

e) the chamber shall be properly vented to prevent pressure built-up and allow uniform distribution of the salt mist. The discharge end of the vent shall be protected from strong draughts, which can cause strong air currents in the chamber.

NOTE — The sprayed solution shall not be re-used.

C-1.1.1 *Atomizer(s)*

The atomizer(s) shall be of such a design and construction as to produce a finely divided, wet, dense mist. The atomizer(s) shall be made of material that is non-reactive to the salt solution.

C-1.1.2 *Air Supply*

If use is made of compressed air, that air shall, when entering the atomizer(s), be essentially free from all impurities, such as oil, dust.

Means shall be provided to humidify the compressed air as required to meet the operating conditions. The air pressure shall be suitable to produce a finely divided dense mist with the atomizer(s) used.

To ensure against clogging of the atomizer(s) by salt deposition, the air is recommended to have a relative humidity of at least 85 percent at the point of release from the nozzle. A satisfactory method is to pass the air in very fine bubbles through a tower containing water, which should be automatically maintained at a constant level. The temperature of this water shall be not less than that of the chamber.

The air pressure shall be capable of adjustment so that the collection rate as specified in **C-3.2** is maintained.

C-1.2 Humidity Chamber

The chamber shall maintain a humidity of 93 +2/–3 percent at a temperature of 40 ± 2°C.

C-2 SALT SOLUTION

C-2.1 Five Percent Sodium Chloride (NaCl) Solution

C-2.1.1 The salt used for the test shall be high-quality sodium chloride (NaCl) containing, when dry, not more than 0.1 percent sodium iodide and not more than 0.3 percent of total impurities.

The salt solution concentration shall be 5 percent ± 1 percent by weight.

The solution shall be prepared by dissolving 5 ± 1 parts by weight of salt in 95 parts by weight of distilled or demineralized water.

C-2.1.2 The *p*H-value of solution shall be between 6.5 and 7.2 at a temperature of 20 ± 2°C.

The *p*H-value shall be maintained within this range during conditioning; for this purpose, diluted hydrochloric acid or sodium hydroxide may be used to adjust the *p*H-value, provided that the concentration of NaCl remains within the prescribed limits. The *p*H-value shall be measured when preparing each new batch of solution.

C-3 TESTING

C-3.1 The specimen shall be placed in the salt mist chamber, and sprayed with the salt solution, for a period of two hours at a temperature 20 ± 5°C.

C-3.2 A minimum of two receptacles shall be used to ensure that the salt mist condition is maintained in all parts of the exposure zone. Each clean collecting receptacle with a horizontal collecting area of 80 cm^2, placed at any point in the exposure zone, shall collect between 1.0 ml to 2.0 ml of solution per hour, averaged over the collecting period. The receptacles shall be placed such that the specimen does not shield them and so that no condensate from any source shall be collected.

NOTE — When calibrating the spray rate of the chamber, a minimum spray period of eight hour should be used for accurate measurement purposes.

C-3.3 At the end of the spray period, the specimen shall be transferred to the humidity chamber and stored at a temperature of 40 ± 2°C and a relative humidity of 93 +2/–3 percent.

At the end of testing the specimen shall be washed in running tap water for five minutes rinsed in distilled or demineralized water, shaken by hand or subjected to air blast to remove droplets of water, then dried for one hour at 55 ± 2°C and allowed to cool under controlled recovery conditions for not less than one hour and not more than two hour.

ANNEX D

(*Clause* 9.10.3)

COPPER ALLOYS — AMMONIA TEST FOR STRESS CORROSION RESISTANCE

D-1 PRINCIPLE

Exposure of test pieces to an ammoniacal atmosphere for 24 h followed by examination for cracks at a magnification of 10*x* to 15*x*.

D-2 TERMINOLOGY

D-2.1 Stress Corrosion — A process involving conjoint corrosion and straining of the metal due to residual or applied stress.

D-2.2 Applied Stress — Stress in a body due to application of an external load.

D-2.3 Residual Stress — Stress remaining within a body as the result of plastic deformation.

D-3 REAGENTS AND MATERIALS

D-3.1 Ammonium Chloride 4 mol/L Solution for the Preparation of the Test Solution

Dissolve 107 ± 0.1 g of ammonium chloride (NH_4Cl) in distilled water, make up the volume to 500 ml and keep the solution in a closed vessel.

D-3.2 Sodium Hydroxide 30 to 50 Percent (m/m) Solution for Adjusting the *p*H-Value

D-3.3 Clean Organic Solvent (for example, Trichloro Ethylene) or Hot Alkaline Solution for Degreasing the Test Pieces

D-3.4 Sulphuric Acid, 5 Percent (m/m) Solution for Cleaning the Test Pieces

D-3.5 Hydrogen Peroxide 30 Percent (m/m) Solution for Addition to the Pickling Solution

D-4 TEST APPARATUS

D-4.1 Ordinary Laboratory Apparatus

D-4.2 *p*H-Meter

D-4.3 Closed Vessel such as Desiccator

D-4.4 Equipment for Examining Test Pieces at Magnification 10*x* to 15*x*

D-5 TEST MEDIA

D-5.1 Slowly add sodium hydroxide solution to ammonium chloride solution to give a test solution with the specified *p*H-value ± 0.05. Maintain the solution at ambient temperature and dilute with water up to a volume of 1 000 ml. Check the *p*H-value with the *p*H-meter after dilution. Prepare the solution preferably in a fume cupboard in a laboratory and store it in a closed vessel. Before use, check the *p*H-value again, and adjust it if necessary.

D-5.1.1 On the basis of the known correlation between the behaviour of test pieces in the ammonia test and the behaviour of copper alloy products under service conditions, the following *p*H-values are recommended on being representative of atmospheres of different corrosiveness and corresponding to different safety requirement:

Corrosiveness of Atmosphere	*p*H-*Value* Safety requirement	
	Low	High
Low		
Indoor atmosphere under dry conditions	9.3	9.5
Moderate		
Indoor atmosphere with risk of formation of condensation	9.5	10.0
Outdoor atmosphere, temperate climate	9.5	10.0
High		
Atmosphere with ammoniacal pollution, for example in stables	10.0	10.5

D-5.2 The pickling solution for cleaning test pieces before and after testing shall be 5 percent (m/m) sulphuric acid. If necessary, for cleaning test pieces after testing, a small amount of hydrogen peroxide solution may be added to the pickling solution (for example, 20 to 50 ml of hydrogen peroxide solution per litre of pickling solution).

D-6 PROCEDURE

D-6.1 Degrease the test piece using the clean organic solvent or the hot alkaline solution.

D-6.2 After degreasing, clean the test piece in the pickling solution and immediately thereafter thoroughly rinse it, first in cold running water, then in hot water, and finally completely dry it in a stream of warm air.

D-6.3 Allow the dry test piece to reach the exposure temperature between 20°C to 30°C, and transfer it to the closed vessel at the same temperature, and containing the freshly prepared test solution at the specified *p*H value. Place the test piece in the vessel in such a way that the ammonia vapour has free access to all surfaces.

The volume of test solution shall be at least 200 ml per litre of total vessel volume and at least 100 ml per square decimeter of test piece surface. The exposure temperature shall be between 20°C to 30°C.

D-6.4 After exposure, remove the test piece from the closed vessel and immediately clean it in the pickling solution for a few minutes at ambient temperature (below 40°C), that is until the surfaces of the test piece are sufficiently clean from corrosion products to allow observation of possible cracks. After rinsing in water and drying in warm air, as specified in **C-6.2** examine the surfaces of the test piece for cracks at a magnification of 10*x* to 15*x*. Before inspection, it may be necessary to deform the test piece slightly so that the fine cracks are opened up and more readily seen. For heavy sections, a slice may be cut to facilitate bending. Cracks within a 5 mm wide zone along cut or sawn edges, or around punched markings, originating from the test piece preparation shall be disregarded. For thin sections (below 0.2 mm), check by metallographic examination whether observed cracks represent stress corrosion cracking or intergranular corrosion.

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Gas Cylinders Sectional Committee, ME 16

Organization	*Representative(s)*
Department of Explosives, Nagpur	Shri R. H. Bhalekar (***Chairman***) Shri Shambhu Prasad (*Alternate*)
All India Industrial Gases Manufacturers Association, New Delhi	Dr P. L. Bhatia Shri B. N. Qanungo (*Alternate*)
Balmer Lawrie & Co Ltd, Mathura	Shri K. Gopinathan Shri Debashis Dass (*Alternate*)
Bharat Petroleum Corporation Ltd, Mumbai	Shri George Paul Shri S. K. Dey (*Alternate* I) Shri Suresh Nair (*Alternate* II)
Bharat Pumps & Compressors Ltd, Allahabad	Shri K. C. Joshi Shri S. K. Tewari (*Alternate*)
BOC India Ltd, Kolkata	Shri P. K. Bhattacharya Shri N. R. Pal (*Alternate*)
Everest Kanto Cylinder Ltd, Aurangabad	Shri Ajit K. Parikh Shri P. M. Samvatsar (*Alternate* I) Shri A. G. Khamkar (*Alternate* II)
Hindustan Petroleum Corpn Ltd, Mumbai	Shri K. Krishnan Shri D. N. Krishnamurthy (*Alternate*)
Hindustan Wires Ltd, Faridabad	Shri R. Tandon Shri N. K. Sawhney (*Alternate*)
Indian Gas Cylinders, Faridabad	Shri E. M. Patel Shri D. C. Jain (*Alternate*)
Indian Oil Corpn Ltd, Mumbai	Shri B. L. Bansal Shri A. N. Khapre (*Alternate*)
International Industrial Gases Ltd, Kolkata	Shri Devendra K. Garg Shri Nikhilesh K. Garg (*Alternate*)
J. R. Fabricators Ltd, Mumbai	Shri Ashwin H. Mehta Shri S. Seshkumar (*Alternate*)
Kabsons Gas Equipments Ltd, Hyderabad	Shri Satish Kabra Shri Satyanarayan Soni (*Alternate*)
Kosan Industries Ltd, Mumbai	Shri A. T. Azavedo Shri D. R. Bhagalia (*Alternate*)
LPG Equipment Research Centre, Bangalore	Shri I. M. Bhola Shri S. M. Venugopal (*Alternate*)
Maruti Koatsu Cylinders Ltd, Mumbai	Shri Nitin J. Thakkar Shri A. S. Saran (*Alternate*)
Met Lab Services Pvt Ltd, Mumbai	Shri S. C. Parikh Shri Sudhir Kaul (*Alternate*)
Ministry of Defence (R&D), Pune	Shri N. K. Chopra Shri A. Basu (*Alternate*)
Ministry of Defence, Pune	Shri K. Parthiban Shri D. D. Bangar (*Alternate*)
Nagpur Fabriforge Pvt Ltd, Nagpur	Shri G. L. Neema Shri A. M. Tijre (*Alternate*)
National Safety Council, Mumbai	Shri H. N. Gupta

(*Continued on page* 19)

(*Continued from page* 18)

Organization	*Representative(s)*
Shri Shakti LPG Ltd, Hyderabad	Shri J. P. Ramappa Shri K. V. Chalapathy Rao (*Alternate*)
In Personal Capacity (*303, Shantikunj, Athwalines, Surat - 395007*)	Shri L. D. Thakkar
BIS Directorate General	Shri M. L. Chopra, Director & Head (MED) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri S. B. Roy
Director (MED), BIS

Gas Cylinder Valves and Fittings Subcommittee, ME 16:1

In Personal Capacity (*303, Shantikunj, Athwalines, Surat - 395007*)	Shri L. D. Thakkar (***Convener***)
All India Industrial Gases Manufacturers Association, New Delhi	Dr P. L. Bhatia
Balmer Lawrie & Co Ltd, Mathura	Shri K. Gopinathan Shri Debashis Dass (*Alternate*)
Bharat Petroleum Corporation Ltd, Mumbai	Shri George Paul Shri S. K. Dey (*Alternate* I) Shri Suresh Nair (*Alternate* II)
Bharat Pumps & Compressors Ltd, Allahabad	Shri S. K. Towari Shri K. G. Shukla (*Alternate*)
BOC India Ltd, Kolkata	Shri P. K. Bhattacharya Shri N. R. Pal (*Alternate*)
Department of Explosives, Nagpur	Shri R. N. Bhalekar Shri Shambhu Prasad (*Alternate*)
Directorate General of Technical Development, New Delhi	Shri M. K. Banerjee
Everest Kanto Cylinder Ltd, Mumbai	Shri Ajit K. Parikh Shri P. M. Samvatsar (*Alternate* I) Shri A. G. Khamkar (*Alternate* II)
Hindustan Petroleum Corpn Ltd, Mumbai	Shri S. V. Sahni Shri D. N. Krishnamurty (*Alternate* I) Shri S. Sreenivasulu (*Alternate* II)
Hindustan Wires Ltd, Faridabad	Shri B. Tandon Shri N. K. Sawhney (*Alternate*)
Indian Oil Corpn Ltd, Mumbai	Shri B. L. Bansal Shri A. N. Khapre (*Alternate*)
Industrial Oxygen Co Pvt Ltd, Mumbai	Shri R. R. Siganporia
Jai Maruti Gas Cylinders Pvt Ltd, Gwalior	Shri Ashok K. Nigam Shri R. K. Nigam (*Alternate*)
Kabsons Gas Equipments Ltd, Hyderabad	Shri Satish Kabra Shri Satyanarayan Soni (*Alternate*)
Kosan Industries Ltd, Mumbai	Shri A. T. Azavedo Shri S. B. Bolmal (*Alternate*)
LPG Equipment Research Centre, Bangalore	Shri A. P. Chelvaroyan Shri S. H. Venugopal (*Alternate*)
M. N. Dastur & Co Ltd, Kolkata	Shri A. K. Chakrabarty Shri P. K. Bandyopadhyay (*Alternate*)
The Industrial Gases Ltd, Kolkata	Shri A. Garg
Tekno Valves, Kolkata	Shri Y. K. Behani Shri R. Behani (*Alternate*)
Vanaz Engineers Pvt Ltd, Pune	Shri S. K. Khandekar Shri S. R. Sarwate (*Alternate* I) Shri S. J. Vispute (*Alternate* II)

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. ME 16 (0576).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	323 76 17 323 38 41
Eastern	: 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160 022	60 38 43 60 20 25
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600 113	254 12 16, 254 14 42 254 25 19, 254 13 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	832 92 95, 832 78 58 832 78 91, 832 78 92

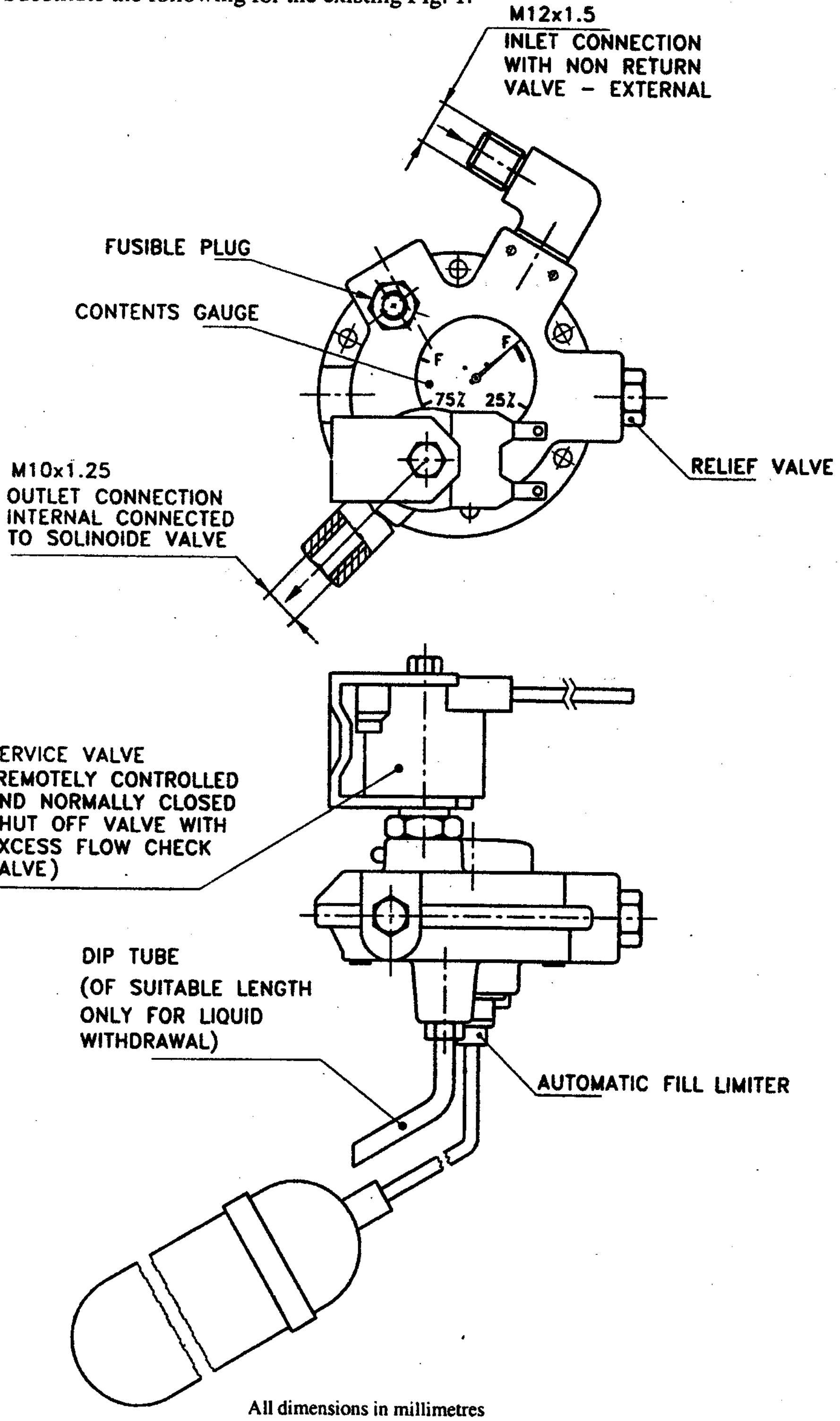
Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.

Printed at Prabhat Offset Press, New Delhi-2

AMENDMENT NO. 1 MARCH 2003
TO
IS 15100 : 2001 MULTI FUNCTION VALVE ASSEMBLY FOR PERMANENTLY FIXED LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS FOR AUTOMOTIVE USE

(*Page* 1, *clause* 3.1.4.2) —Substitute '120°C ± 10°C' *for* '100°C + 4°C / – 2°C.

(*Page* 2, *Fig.* 1) — Substitute the following for the existing Fig. 1.


M12x1.5
INLET CONNECTION WITH NON RETURN VALVE - EXTERNAL
FUSIBLE PLUG
CONTENTS GAUGE
F
F
75%
25%
RELIEF VALVE
M10x1.25
OUTLET CONNECTION INTERNAL CONNECTED TO SOLINOIDE VALVE
SERVICE VALVE (REMOTELY CONTROLLED AND NORMALLY CLOSED SHUT OFF VALVE WITH EXCESS FLOW CHECK VALVE)
DIP TUBE (OF SUITABLE LENGTH ONLY FOR LIQUID WITHDRAWAL)
AUTOMATIC FILL LIMITER

All dimensions in millimetres

FIG. 1 GENERAL LAYOUT OF MULTI FUNCTION VALVE (ILLUSTRATIVE)

Gr 2

(*Page* 3, *clause* **3.1.5.3,** *Note*) — Substitute the following for the existing Note:

NOTE — Multi function valve seal box for housing the multi function valve shall be metallic or non-metallic box, which covers the multi function valve, its joints with auto LPG container and the fittings. The seal box shall comply with the following:

a) Its construction shall be such that any gas, which might leak from any of the above fittings, cannot pass to any other enclosed compartment, passenger space or luggage space of the vehicle.

b) The multi function valve seal box provides free passage to atmosphere away from passenger compartment through a suitable flexible pipe.

c) The multi function valve seal box shall meet all the requirements of safety code of practice for auto LPG.

(*Page* 6, *clause* **5.5.2**) — Substitute the following for the existing clause:

5.5.2 *Inlet Connection*

The multi function valve inlet shall have parallel male (external) threads of size of M 12 × 1.5.

(*Page* 6, *clause* **5.5.3**) — Substitute the following for the existing clause:

5.5.3 *Outlet Connection*

The multi function valve outlet shall have parallel female (internal) threads of size of M 10 × 1.25.

(*Page* 6, *clause* **7.2**) — Insert the following new clause after **7.2**:

7.3 Routine Tests

a) External leakage test (*see* **9.3**), and

b) Seat leakage test (*see* **9.6**).

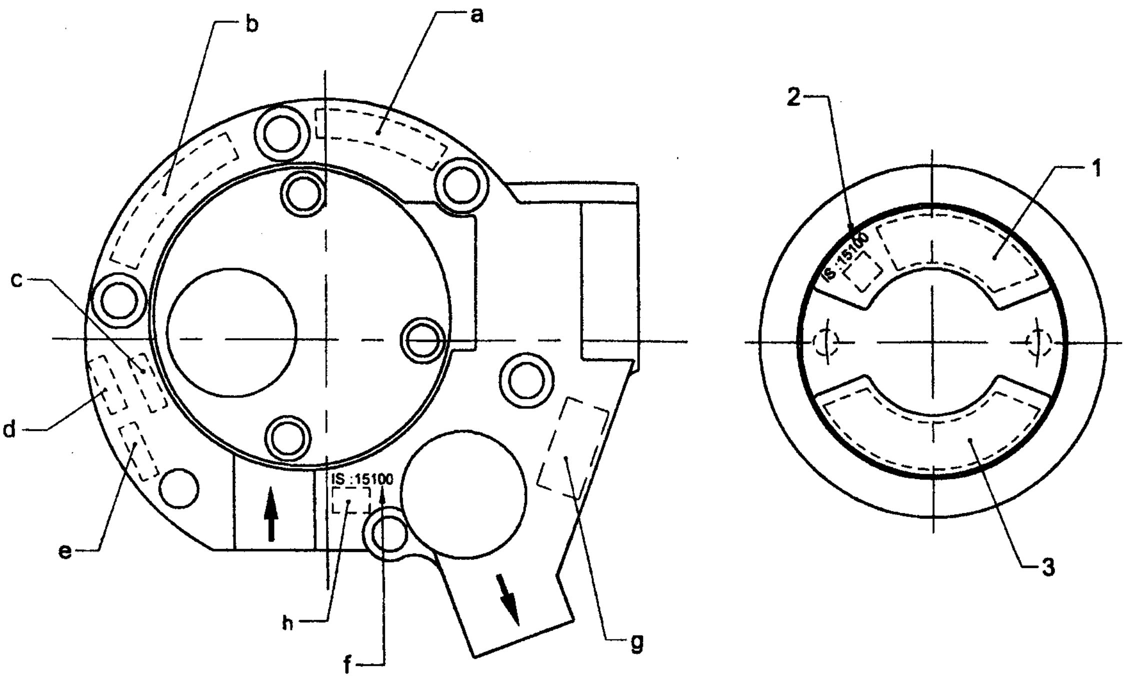
(*Page* 13, *clause* **10.1**) — Insert the following clause after **10.1**:

10.1.1 Each filler connector shall be permanently marked with the following information (*see* Fig. 5 on page 3):

a) Particulars of specification,

b) Manufacturers' identification, and

c) Model number.



MULTI-VALVE BODY

FILLER CONNECTOR

POSITION	DESCRIPTION	SIZE (mm)
a	Manufacturers identificatin mark	3
b	Model number	3
c	Mounting angle and Dia. of auto LPG tank	3
d	Quarter & year of manufacture	3
e	PRV flow rate at flow rating pressure	3
f	Specification number	2
g	Maximum working pressure	2
h	Inspection mark / Certifying agency's mark	3

POSITION	DESCRIPTION	SIZE (mm)
1	Model number	3
2	Specification number	2
3	Manufacturers identification mark	3

FIG. 5 MARKING DETAILS

AMENDMENT NO. 2 MARCH 2004
TO
IS 15100 : 2001 MULTI FUNCTION VALVE ASSEMBLY FOR PERMANENTLY FIXED LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS FOR AUTOMOTIVE USE

(*Page* 6, *clause* **9.1.5**) — Substitute the following for the existing:

'**9.1.5** All tests may be performed at room temperature unless otherwise stated.'

(*Page* 10, *clause* **9.8.4**) — Substitute the following for the existing:

'**9.8.4** *Charging-Speed Test*

Testing of the good function of the device limiting the filling degree of the container has to be performed by filling speeds of 20, 50 and 80 litres per minute.

NOTE — Tests at filling speed 80 litres per minute is optional.'

[*Page* 13, *clause* **10.1** (*see also Amendment No.* 1)] – Delete 'g' and 'Note' and renumber the subsequent Sl No.

(*Page* 13, *clause* **10.1**) — Substitute the following at the end:

'j) Each multi function valve shall be permanently marked with the information given in Fig. 5.

NOTE — Size of the letters for guidance only. Markings should be legible'.

[*Page* 13, *clause* **10.1.1** (*see also Amendment No.* 1)] – Insert the following at the end:

NOTE — Size of the letters for guidance only. Markings should be legible.'

(*Page* 15, *Annex* **C-2.1.2**) —Substitute the following for the existing:

'**C-2.1.2** The *p*H-value of solution shall be between 6.5 and 7.2 at a temperature of 20± 5°C.'

(ME 16)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 MAY 2007
TO
IS 15100 : 2001 MULTI FUNCTION VALVE ASSEMBLY FOR PERMANENTLY FIXED LIQUEFIED PETROLEUM GAS (LPG) CONTAINERS FOR AUTOMOTIVE USE

(*Page* 1, *clause* **3.1.3.1**, *first sentence*) — Substitute the following for the existing:

'A valve normally in the open position which closes automatically when differential pressure across the valve is not more than 0.1 MPa.'

(*Page* 1, *clause* **3.1.3.3**) — Substitute the following for the existing clause:

'When the excess flow check valve is in cut-off position, the liquid flow through the equalizing device shall not exceed 500 cm^3/min at a differential pressure of 0.7 MPa for valves suitable for liquid withdrawal.'

[*Page* 6, *clause* **5.5.2** (*see also Amendment No.* 1)] — Substitute the following for the existing:

'The multifunction valve inlet shall have parallel male (external) threads of size M12×1.5 or equivalent approved by statutory authority.'

(*Page* 6, *clause* **8.2**) — Insert the following new clause after **8.2**:

'8.3 **Bon-Fire Test** — A multifunction valve shall be subjected to bon-fire test as per procedure given in **10.6.1** of IS 14899.'

(*Page* 9, *clause* **9.8.1.3.7**, *last sentence*) — Substitute the following for the existing:

'The pressure valve under test shall be connected either to the discharge end of the flow meter or upstream side of the flow meter.'

(*Page* 10, *clause* **9.8.2.2**, *second sentence*) — Substitute the following for the existing:

'A valve intended for use only with liquid shall be tested with water and valve intended for use with vapour shall be tested with air.'

(*Page* 12, *clause* **9.10.1**, *third line*) — Substitute 'after' *for* 'and after'.

(*Page* 12, *clause* **9.10.2**, *third line*) — Substitute 'after' *for* 'and after'.

(*Page* 12, *clause* **9.10.3**, *third line*) — Substitute 'after' *for* 'and after'.

(*Page* 13, *Annex* A) — Insert the following at the appropriate place:

14899 : 2000	Multifunction valve assembly for permanently fixed liquefied petroleum gas (LPG) containers for automotive use

(ME 16)

Reprography Unit, BIS, New Delhi, India